

Waseem S. Bakr, Ph.D.

CONTACT INFORMATION

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RESEARCH INTERESTS

Strongly correlated many-body systems, degenerate gases in optical lattices, quantum gas microscopy, quantum magnetism, topological phases, Rydberg atoms, ultracold polar molecules, novel techniques for cooling quantum gases, fermionic superfluidity in two-dimensional and layered systems, ion trap and optical lattice quantum computation.

EDUCATION

Ph.D. in Physics, May 2011
Harvard University

Dissertation: Microscopic studies of quantum phase transitions in optical lattices
Advisor: Markus Greiner

M.Eng. in Electrical Engineering & Computer Science, May 2006
Massachusetts Institute of Technology (MIT)

Dissertation: Towards a cryogenic planar ion trap for Sr-88
Advisor: Isaac Chuang

S.B. in Physics, MIT, May 2005

S.B. in Electrical Engineering & Computer Science, MIT, May 2005

APPOINTMENTS

- Assistant Professor of Physics, Princeton University, Sep. 2013 – present.
- Post-doctoral Research Fellow, Massachusetts Inst. of Technology, July 2011 – Aug. 2013.
- Graduate Research Assistant, Harvard University, Sep. 2006 – May 2011.
- Graduate Research Assistant, Massachusetts Inst. of Technology, Sep. 2005 – Aug. 2006.

TEACHING AND ADVISING EXPERIENCE

- Advanced Electromagnetism (Phy 304), Spring 2016
- An Integrated Introduction to Engineering, Mathematics & Physics (Phy 191), Fall 2016
- General Physics II (Phy 104), Spring 2015, Spring 2016
- General Physics I (Phy103), Fall 2013
- Physics 11b: Electricity, Magnetism and Waves, 2010.
- Advisor for two post-doctoral fellows, four graduate students and five undergraduates.

HONORS AND AWARDS

- Packard Fellowship in Science & Engineering, 2016
- AFOSR Young Investigator award, 2016
- Alfred P. Sloan Research Fellowship, 2014
- MIT Infinite K Award, 2013

- DAMOP Outstanding Doctoral Thesis award, 2012
- AAAS Newcomb Cleveland Prize, 2011
- Research in Bakr *et al*, Science selected as one of the top ten scientific breakthroughs of 2010 by Science magazine, 2010
- DARPA best paper award, 2010
- Purcell Fellowship, Harvard University, 2006
- Sheikha Fatima bint Mubarak Scholarship, 2001-2005

ACADEMIC SERVICE

- Referee for *Physical Review Letters*, *Physical Review A*, *Nature Physics*, *Nature Communications*, *Science*, *Nature*.
- Proposal reviewer for the National Science Foundation (NSF) and Defense Threat Reduction Agency (DTRA).

PUBLICATIONS

Mitra, D., Brown, P., Guardado-Sanchez, E., Kondov, S., Devakul, T., Huse, D. Schauss, P. & **Bakr, W.**

Quantum gas microscopy of an attractive Fermi-Hubbard system
arxiv: 1705.02039 (2017)

Brown, P., Mitra, D., Guardado-Sanchez, E., Schauss, P., Kondov, S., Khatami, E., Paiva, T., Trivedi, N., Huse, D. & **Bakr, W.**

Observation of canted antiferromagnetism with ultracold fermions in an optical lattice
arxiv: 1612.07746 (2016)

Mitra, D., Brown, P., Schauss, P., Kondov, S. & **Bakr, W.**

Phase separation and pair condensation in a spin-imbalanced 2D Fermi gas
Phys. Rev. Lett. 117, 093601 (2016)

Cheuk, L., Nichols, M., Okan, M., Gersdorf, T., Ramasesh, V., **Bakr, W.**, Lompe, T. & Zwierlein, M.

Quantum gas microscope for fermionic atoms
Phys. Rev. Lett. 114, 193001 (2015)

Bakr, W.

Ultracold atoms: pairing with a twist
Nature Physics, 10, 90-91 (2014)

Yefsah, T., Sommer, A., Ku, M., Cheuk, L., Ji, W., **Bakr, W.** & Zwierlein, M.

Heavy solitons in a fermionic superfluid
Nature 499, 426-430 (2013) [Selected for a Nature “News and Views”]

Bakr, W., Cheuk, L., Ku, M., Park, J., Sommer, A., Will, S., Wu, C., Yefsah, T. & Zwierlein, M.

Strongly interacting Fermi gases
EPJ Web of Conferences 57, 01002 (2013)

Cheuk, L., Sommer, A., Hadzibabic, Z., Yefsah, T., **Bakr, W.** & Zwierlein, M.

Spin-injection spectroscopy of a spin-orbit coupled Fermi gas
Phys. Rev. Lett. 109, 095302 (2012) [Selected for a PRL “Viewpoint” & “Editors’ Suggestion”]

Sommer, A., Cheuk, L., Ku, M., **Bakr, W.** & Zwierlein, M.
Evolution of fermion pairing from three to two dimensions
Phys. Rev. Lett. 108, 045302 (2012) [Selected for a PRL “Viewpoint”]

Bakr, W., Preiss, P., Tai, M., Ma, R., Simon, J., & Greiner, M.
Orbital excitation blockade and algorithmic cooling in quantum gases
Nature 480, 500-503 (2011) [Selected for a Nature “News and Views”]

Ma, R., Tai, M., Preiss, P., **Bakr, W.**, Simon, J., & Greiner, M.
Photon-assisted tunneling in a biased, strongly correlated Bose gas
Phys. Rev. Lett. 107, 095301 (2011)

Simon, J., **Bakr, W.**, Ma, R., Tai, M., Preiss, P. & Greiner, M.
Quantum simulation of antiferromagnetic spin chains in an optical lattice
Nature 472, 307-312 (2011) [Selected for a Nature “News and Views”]

Brachmann, J., **Bakr, W.**, Gillen, J., Peng, A. & Greiner, M.
Inducing vortices in a Bose Einstein condensate using holographically produced light beams
Optics Express 19, 12984-12291 (2011)

Bakr, W., Peng, A., Tai, E., Ma, R., Simon, J., Gillen, J., Foelling, S., Pollet, L. & Greiner, M.
Probing the superfluid-to-Mott-insulator transition at the single-atom level
Science 329, 547-550 (2010) [Selected for a Science “Perspective”]

Bakr, W., Gillen, J., Peng, A., Foelling, S. & Greiner, M.
A quantum gas microscope for detecting single atoms in a Hubbard-regime optical lattice
Nature 462, 74-77 (2009)

Gillen, J., **Bakr, W.**, Peng, A., Unterwaditzer, P., Foelling, S. & Greiner, M.
Two-dimensional quantum gas in a hybrid surface trap
Phys. Rev. A 80, 021602(R) (2009)

Antohti, P., Schuster, D., Akselrod, G., Labaziewicz, J., Ge, Y., Lin, Z., **Bakr, W.** & Chuang, I.
Cryogenic ion trapping systems with surface-electrode traps
Rev. Sci. Instrum. 80, 013103 (2009)

Leibrandt, D., Clark, R., Labaziewicz, J., Antohti, P., **Bakr, W.**, Brown, K. & Chuang, I.
Laser ablation loading of a surface-electrode ion trap
Phys. Rev. A 76, 055403 (2007)

Pearson, C., Leibrandt, D., **Bakr, W.**, Mallard, W., Brown, K. & Chuang, I.
Experimental investigation of planar ion traps
Phys. Rev. A 73, 032307 (2006)

INVITED TALKS

Colloquium Speaker, Rutgers University, New Brunswick, NJ, Mar. 2017
Microscopy of atomic Fermi-Hubbard systems in new regimes

Atomic Physics Seminar, Rice University, Houston, TX, Mar. 2017
Quantum gas microscopy of the Fermi-Hubbard model in new regimes

Atomic Physics Seminar, Harvard University, Cambridge, NJ, Feb. 2017
Spin-imbalance in a 2D Fermi-Hubbard system

Colloquium Speaker, Rowan University, Glassboro, NJ, Apr. 2016
Microscopy of atomic quantum gases

Condensed Matter Seminar, Duke University, Durham, NC, Apr. 2016
Strongly-interacting fermionic superfluids: spin-imbalance, lower dimensionality and topological defects

Invited Speaker, International Conference on Quantum Physics and Nuclear Engineering, London, UK, Mar. 2016
Phase separation and pair condensation in spin-imbalanced 2D Fermi gases

Invited Speaker, Princeton Summer School on Condensed Matter Physics, Princeton, NJ, July 2015
Artificial gauge fields in cold atom systems

Condensed Matter Seminar, Boston University, Boston, MA, May 2015
Synthetic quantum matter with ultracold atoms

Invited Speaker, New Laser Scientist Conference, Tucson, AZ, Oct. 2014
Quantum simulation of the Hubbard model with attractive atomic Fermi gases

Colloquium Speaker, Lehigh University, Bethlehem, PA, Oct. 2014
Synthetic quantum matter with ultracold atoms

Invited Speaker, Workshop on Quantum Gases, Fluids and Solids, Universidade de São Paulo, São Carlos, Brazil, Aug. 2014
Motion of a solitonic vortex in the BEC-BCS crossover

Half-Plenary Speaker, 27th International Conference on Low Temperature Physics, Buenos Aires, Argentina, Aug. 2014
Motion of a solitonic vortex in the BEC-BCS crossover

Condensed Matter Seminar, Princeton University, Princeton, NJ, Dec. 2013
Synthetic condensed matter systems with ultracold atoms

Invited Speaker, ITAMP, Harvard University, Cambridge, MA, Mar. 2013
Spin-orbit coupling and heavy solitons in atomic Fermi gases

JQI Seminar, University of Maryland, College Park, MD, Feb. 2013
Topological excitations in normal and superfluid Fermi gases

QI/AMO Seminar, University of Illinois at Urbana-Champaign, Urbana, IL, Feb. 2013
Condensed matter physics with ultracold atoms: from Mott Insulators to topological superfluids

Invited Speaker, Pennsylvania State University, State College, University Park, PA, Feb. 2013
Condensed matter physics with ultracold atoms: from Mott Insulators to topological superfluids

LASSP Seminar, Cornell University, Ithaca, NY, Jan. 2013
Condensed matter physics with ultracold atoms: from Mott Insulators to topological superfluids

Invited Speaker, Princeton University, Princeton, NJ, Dec. 2012
Condensed matter physics with ultracold atoms: from Mott Insulators to topological superfluids

Invited Speaker, Kavli Institute for Theoretical Physics, Santa Barbara, CA, Sep. 2012
Lower dimensional and spin-orbit coupled Fermi gases: towards simulating topological matter with ultracold atoms

Complex Quantum Systems Seminar, University of Texas, Austin, TX, Sep. 2012
Condensed matter physics with ultracold atoms: from Mott insulators to topological superfluids

Invited Speaker, DAMOP, Anaheim, CA, June 2012
Quantum gas microscopy: an atomic scale probe of strongly-correlated many-body systems

JQI Seminar, National Institute of Standards (JQI), Gaithersburg, MD, May 2011
Microscopic studies of quantum phase transitions in optical lattices

Invited Speaker, Masdar Institute for Science & Tech., Abu Dhabi, UAE, May 2011
Studying dynamical phenomena in synthetic materials

Invited Speaker, CLEO/QELS Conference, San Jose, CA, May 2010
A quantum gas microscope for detecting single atoms in a Hubbard regime optical lattice